Technology - Taiwan

TPCA 2026: stay constructive on substrate amid a greater variety of technologies

Industry Overview

Reiterate positive stance on substrate vs CCL/PCB

After attending TPCA last week, our constructive view on the substrates space is reinforced given the ongoing spec migration along with rising technology barriers. Accordingly, we maintain Buy on Unimicron, NYPCB, Kinsus on the substrate side as well as EMC (moving up to CCL for substrate).

Roadmap diversification seen across substrate/CCL

On technology development, companies in both substrate and CCL areas showed more diversified options to the roadmap ahead, including multi-layer core, glass/ceramic for substrates, and PTFE, hydrocarbon, Q-glass for CCL as we highlighted in (see report) the CCL industry report in early-October. On substrate side, there is continuous content increase of ~50% in each generation of server CPU/GPU, while suppliers also benefit from a bigger boost on pricing vs previous cycles (Exhibit 3). Further, we note SAP may be adopted in 3.2T optical module, creating a new TAM for substrate makers in longer-term. On CCL side, we learnt that 1) EMC's M10-grade CCL (mainly based on HC resin) will enter NPI in 1Q27 while its M11-grade solution (still based on Q-glass) is already in initial R&D stage; and 2) TUC expected the most feasible solution for advanced CCL so far would be CCL core with cloth, plus PP based on HC resin (Exhibit 7). Overall, we believe Q-glass cloth and HC resin seem to be a more suitable set of solutions, when it comes to upgrading CCL in near/mid-term. As for PCB names, our channel checks suggest there could be an ongoing price hike toward 4Q26-1Q27 driven by cost inflation.

Multi-layer core more feasible before glass core

According to the supply chain, multi-layer core substrate is needed to help with warpage control which could emanate from a couple of reasons (e.g. CTE mismatch, uneven copper balance, stack-up asymmetry), and it also enhances the mechanical drill ability and stiffness. Meanwhile, PI becomes more important given the embedded bridge and passive components, while signal integrity has been the focus for data-transmission (which is also supported by multi-layer core solution). Longer-term, glass core substrate seems to have more advantages including only one-third of warpage (vs organic core), lower CTE and higher Young's modulus (stiffness), while ceramic core substrate has the limitation in panel size. Yet, cracking points (SeWaRe) and reliability issues (given the CTE mismatch) remain the hurdles for glass core substrate to commercialize. To elaborate, cracking may not be seen after the panel goes through several processes (e.g. thermal cycle, movement, assembly), which creates a more severe trouble to the suppliers as it is already closer to the end-product level. According to AT&S, it believes the whole supply chain for glass core substrate remains distant from getting ready for mass production. Please refer to p.2 for the key takeaways on CCL/PCB sector.

This research report provides general information only. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or other persons without the express written consent of BofA Securities.
>> Employed by a non-US affiliate of BofAS and is not registered/qualified as a research analyst under the FINRA rules.
Refer to "Other Important Disclosures" for information on certain BofA Securities entities that take responsibility for the information herein in particular jurisdictions.
BofA Securities does and seeks to do business with issuers covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.
Refer to important disclosures on page 11 to 15. Analyst Certification on page 9. Price Objective Basis/Risk on page 8. 13033680

26 October 2026

Equity
Taiwan
Technology

Mike Yang >>
Research Analyst
Merrill Lynch (Taiwan)
+886 2 2376 3729
mike.c.yang@bofa.com

Cathy Hsu >>
Research Analyst
Merrill Lynch (Taiwan)
+886 2 2376 3726
cathy.hsu3@bofa.com

TPCA – Taiwan Printed Circuit Association

NYPCB – Nan Ya Printed Circuit Board

EMC – Elite Material

CCL – copper clad laminate

TUC – Taiwan Union

PTFE – hylene

CPU/GPU – central/graphic processing unit

SAP – semi additive process

HC – hydrocarbon

LT- Long-term

TAM – total addressable market

NPI – new product introduction

R&D – research/development

PP – prepreg

CTE – coefficient of thermal expansion

PI – power integration

PTFE not feasible in L-T; equipment/drilling more critical

Judging from the performance upgrade and processibility in CCL/PCB, Q-glass based solutions seem to strike the balance at least in the near-term. Meanwhile, if hybrid solution is adopted, there may be a big gap in Dk performance by different materials. For longer-term, we also note that CCL suppliers appear to focus more on the low CTE metric vs previously when it comes to future product development, which makes us believe PTFE-based (with high CTE) CCL does not seem to be a long-term (L-T) solution. Further, PTFE-based CCL/PCB still has weaknesses in copper plating, hole drilling and lamination. On PCB side, we learnt that higher-end equipment and drilling suppliers in Japan (e.g. Via, Union Tool) and Taiwan (e.g. Ta Liang, Topoint) are shifting more focus to substrate-related demand, while Japanese suppliers are still less aggressive in capacity addition. In our view, this could lengthen the under-supply situation of high-end PCB/substrate. Further, we learnt from PCB/substrate suppliers that hole-drilling would become more critical in the next 1-2 years, given that 1) PCB layer count would move to 40-50; and 2) there would be more adoptions of multi-layer core substrates.

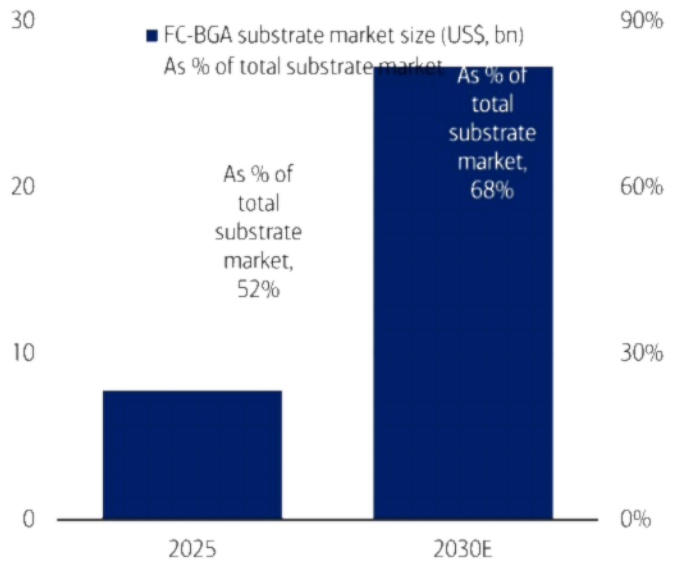
Exhibits related to TAM (total addressable market)

Exhibit 1: Substrate market size trend
The number is expected to reach US$40bn in 2030



Source: BofA Global Research, Prismark

Exhibit 2: FC-BGA (flip chip BGA) substrate market size
FC-BGA substrate is expected to account for ~70% of substrate market size in 2030, vs ~50% in 2025



Source: BofA Global Research, Prismark

Exhibit 3: Substrate market CAGR by value and volume
ASP in substrate market is in an uptrend during 2020-30, contrary to the previous cycles

Item/period	2005-2010	2010-2015	2015-2020	2020-2030E
Value growth CAGR	10.2%	-3.1%	8.0%	14.7%
Volume growth CAGR	20.2%	4.3%	9.0%	5.1%
ASP CAGR	-8.3%	-7.1%	-0.9%	9.1%

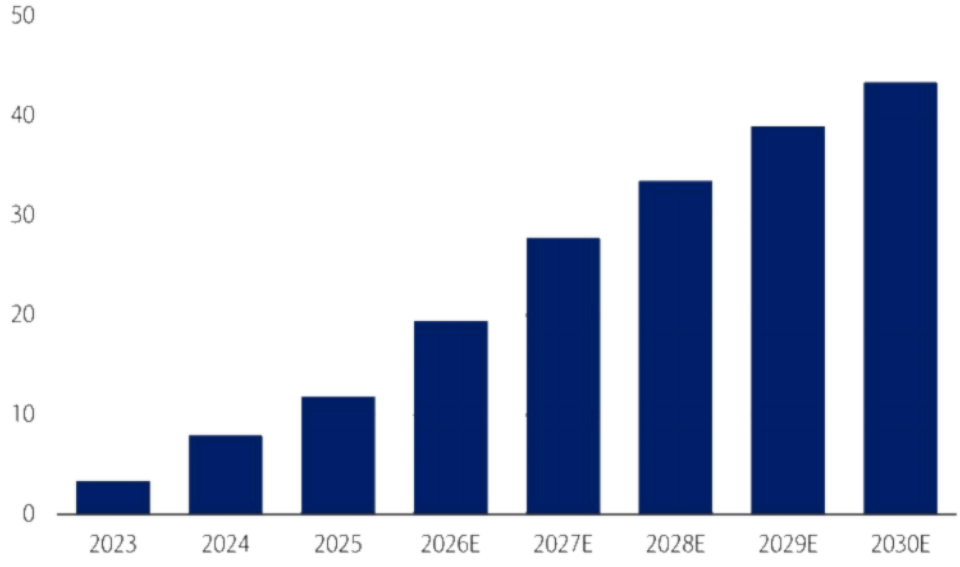
Source: BofA Global Research, Prismark

Exhibit 4: Market value trend by different type of PCB
Substrate and HDI are expected to record the highest growth among all the categories

Manufacturing output value / M USD.	2000	2020	2024	2025	2026F	2030F	2026F/ 2025	2025–2030 CAGR
Commodity PCB	10,324	7,911	7,947	8,440	9,587	11,716	13.6%	6.8%
Multilayer	22,217	24,763	27,994	33,405	45,522	64,166	[illegible]	13.9%
HDI	2,074	9,874	12,518	16,197	22,641	34,004	[illegible]	[illegible]
Package Substrate	3,505	10,188	12,602	14,891	21,472	34,762	[illegible]	[illegible]
Flexible PCB	3,450	12,483	12,504	12,903	14,135	17,680	9.5%	6.5%
Total	**41,570**	**65,219**	**73,565**	**85,836**	**113,357**	**162,329**	**32.1%**	**13.6%**

Source: BofA Global Research, Prismark

Exhibit 5: Unit forecast of AI (artificial intelligence) accelerators in million
The number is expected to grow by 40+% in 2027, and it will reach ~28mn units



Source: BofA Global Research, Prismark

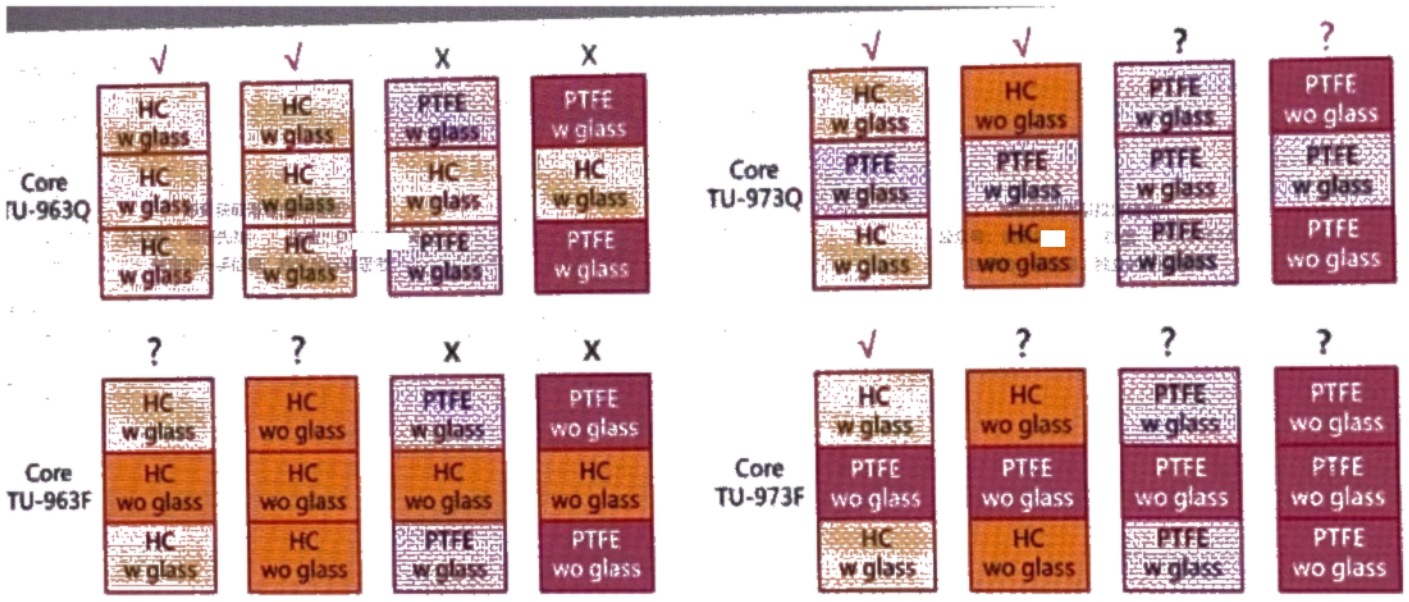
Exhibits related to the PCB/CCL specifications

Exhibit 6: Advanced CCL and PP (prepreg) solutions illustrated by TUC
PTFE-based solutions come up with best performance, but also has the disadvantage in mechanical strength, PCB drilling etc.

Key Challenges in PCB applications	Core pp	PTFE w/o glass PTFE w/o glass	PTFE w/o glass HC with glass	PTFE with glass PTFE with glass	PTFE with Glass HC w/o Glass	PTFE with glass PTFE w/o glass	HC with Glass HC with Glass
Performance (ranking)		1	2	1	2	1	3
CTE (ranking) X/Y/Z		3	2	1	3	2	1
Signal Skew effect @ High frequency		1	2	3	2	1	3
Interfacial Bonding (Resin-Glass fiber)		N/A	N/A / Good	Weak / Weak	Weak / Good	Weak / N/A	Good / Good
Interfacial Bonding (Resin-Resin) core/pp		Medium	Weak	Medium	Weak	Medium	Good
CAF risk		N/A	Low	Medium-High	Medium	Medium-High	Low
Warpage during PCB reflow process		High	Medium High	Low Medium	Medium	Medium	Low
Mechanical Strength		Weak	Medium	Weak-Medium	Medium	Weak-medium	Good
Adaptability to complicated Circuit Design		Weak	Medium-High	Weak	Medium	Weak	Good
Difficulty in Drilling Process		Medium-High	Medium	Medium-High	Medium	Medium-High	Low
Difficulty in Desmear Process		High	Medium	High	Medium	High	Low-Medium
Overall Weighting / Feasibility		X	X	?	V	?	V

Source: BofA Global Research, company data

Exhibit 7: Comparison of feasibility by different pair of CCL and PP based on different materials
Hydrocarbon based PP and CCL with glass cloth are still more feasible solutions, vs PTFE-based PP and CCL without glass cloth



Source: BofA Global Research, company data

Exhibit 8: Comparison of EMC's EM896K3 vs next-generation CCL
A lower CTE and a much lower Df (<0.0004) is seen for next-generation CCL

Item	EM-896K3	Next generation
Tg (DMA, celcius degree)	205	200
XY-CTE (ppm/celcius)	6/8	4/5
Dk @ 10GHz	2.72	2.66
Df @ 10GHz	0.00068	0.00038

Source: BofA Global Research, company data

Exhibit 9: Spec migration by Unimicron's advanced PCB solution
The interconnect pitch features greater density toward 2028

Features/time		2024	2026	2028
Capability of mSAP (um)	Line/space	25/25	18/22	20/20
	Tolerance	+/-5	+/-4	+/-4
Structure (um)	Min. core thickness	49	40	40
	Min. prepreg thickness	25	22	22
Blind vias (um)	Min. blind via diameter	60	50	50
	Min. blind via pad diameter	105	90	90
Interconnect pitch (mm)	BGA/ball pitch	0.13 (mSAP)	0.115 (RCC/mSAP)	0.11 (RCC/mSAP)
Solder resist (um)	Min. SR opening area	75	70	70
	Min. alignment	+/-15	+/-12.5	+/-10
	Min. SR web (BGA area)	70	60	50

Source: BofA Global Research, company data

Exhibits related to the substrate specifications

Exhibit 10: Roadmap toward glass core substrate from organic substrate
Glass core substrate features more advanced performance, but will not become mainstream until 2030 at earliest

Axis	2026	2028	2030
Substrate core	Organic, low-CTE	Organic + early glass core	Glass core mainstream for large body
Build-up line/space	8/8 µm	5/5 µm	2/2 µm in fine tier
Die-to-die	Bridge / 2.5D interposer	Panel RDL at scale	Hybrid bonding at package level
SerDes rate	112G PAM4	224G PAM4	224G + co-packaged optics
Package power	~1,000 W	~1,500 W	>2,000 W with vertical delivery
PCB dielectric	Ultra low loss	Extreme low loss	Hybrid low-loss + optical bypass

Source: BofA Global Research

Exhibit 11: Comparison of different types of advanced substrate solutions
Both glass core and ceramic core substrates features certain advantages, but also come up with different limitations

Property	Advanced low-CTE Organic core	Glass Core	Ceramic Core (HTCC Alumina)
Representative Material	Resin + Glass Cloth	Alkali-free glass	Al_2O_3 (96–99.6%)
CTE (ppm/K)	5 ~ 7	3~4	6.5 ~ 7.5
Young's Modulus (GPa)	35 ~ 37	70~90	280~330
Thermal Conductivity (W/m·K)	0.3 ~ 0.5	1 ~ 1.5	18~25
Dielectric Constant (Dk)	4.1 ~ 4.6	4 ~ 7	9 ~ 10
Dissipation Factor (Df)	0.005 ~ 0.011	0.001 ~ 0.01	0.0005 ~ 0.003
Dimensional Stability	Moderate	High	Very High
Large Panel Capability	High	High	Limited
Technological Maturity	Very High	Low	Moderate

Source: BofA Global Research

Exhibit 12: Comparison of metrics among glass core substrate based on different CTE
The solution that features low CTE and high stiffness also comes along with challenges (SeWaRE, reliability) that need to overcome

Glass CTE	Warpage (After Assembly)	SeWaRe (After Singulation)	Reliability (T/S 1000cyc)
High CTE	High	No SeWaRe	Pass
Medium CTE	Middle	10-2-10	Pass
Low CTE	Low	7-2-7	Fail

Source: BofA Global Research, company data

人在草木间

Exhibit 13: High-density ABF substrate roadmap by Shinko
The roadmap was introduced in 2024 with smaller bump pitch expected toward 2033

Roadmap (in um)	2024	2027	2030	2033
Bump pitch	55	35	30	25
Land dia.	21	21	17	13
Via dia.	10	10	7	5
Position accuracy	5.5	5.5	5.0	4.0

Source: BofA Global Research, company data

Exhibit 14: Spec migrations of Unimicron's substrate embedded with passive components
There is a trend of finer L/S (line/space) and lower Df toward 2028

Time		2026		2027	2028
Features (in um)		Production	NPI		
Structure		10/2/10; 8/6/8	18/2/18; 10/n/10	14/n/14	16/n/16
Max body size (mm)		93x93	120x120	120x150	150x150
Bump area	pitch	110	90	85	80
	SRO	50	45	45	40
Build up layer	line/space	8/10	7/8	7/8	5/5
	Min. via/land diameter	50/75	40/67	40/62	30/55
Core layer	line/space	25/25	20/25	20/25	20/25
Highspeed dielectric loss tangent (under 10GHz)		0.0034	0.0022	0.002	0.002

Source: BofA Global Research, company data

Exhibit 15: Spec migrations of Unimicron's BGA (ball grid array) substrate
There is a trend of greater thickness, and finer line/space toward 2028

Time		2026		2027	2028
Features (in um)		Production	NPI		
Structure		9/6/2009	10/8/2010	14/n/14	16/n/16
Max body size (mm)		110x110	120x150	230x150	230x230
Thickness for core layer (mm)		3.2	4.5	4.7	5.1
Bump area	pitch	150	130	130	110
	SRO	70	60	60	55
Build up layer	line/space	14/14	12/12	12/12	9/12
	Min. via/land diameter	60/85	50/75	45/70	40/65
Core layer	line/space	75/75	70/70	65/65	60/60
Highspeed dielectric loss tangent (under 10GHz)		0.0034	0.0034	0.0022	0.0022

Source: BofA Global Research, company data

Exhibits related to the products

Exhibit 16: Illustration of MPI's TS-3500DS probe station
The equipment features double-sided testing for silicon photonics



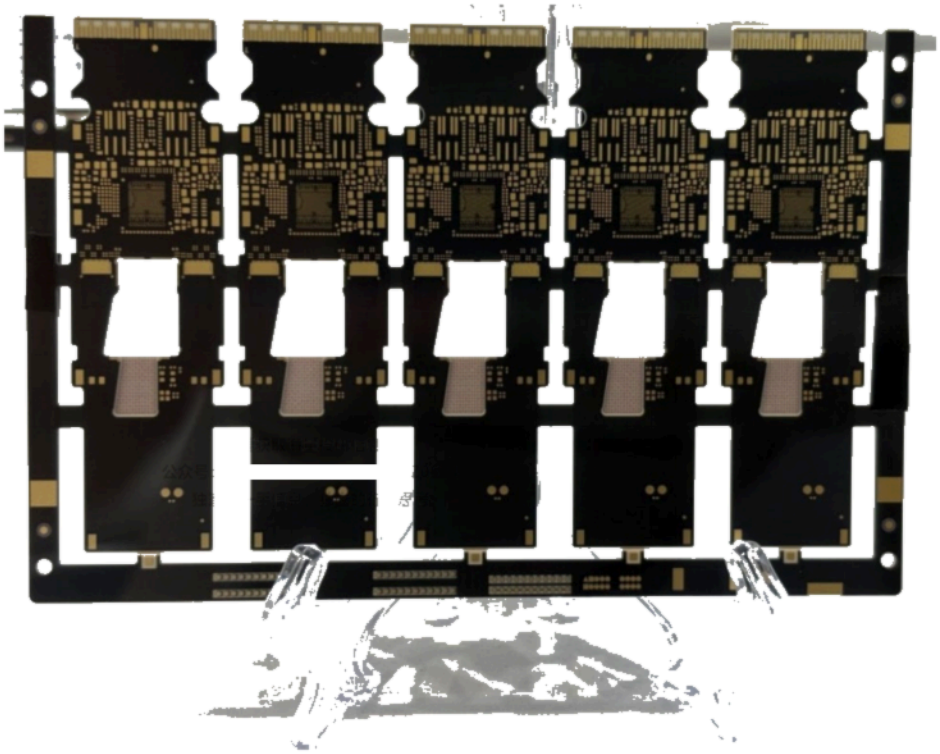
Source: BofA Global Research, company data

Exhibit 17: Illustration of MPI's DTS650-DI equipment
The equipment supports bar/die/packaged type of testing



Source: BofA Global Research, company data

Exhibit 18: Illustration of Unimicron's optical module PCB
The product features mSAP technology with 40/30um line/space



Source: BofA Global Research, company data

Exhibit 19: Stocks mentioned
Prices and ratings for stocks mentioned in the report

BofA ticker	Ticker	Company name	Price (LC)	Rating
UMCRF	3037 TT	Unimicron	NT$ 1085	C-1-7
NANYF	8046 TT	NYPCB	NT$ 1265	C-1-7
KNSUF	3189 TT	Kinsus	NT$ 986	C-1-7
ETMCF	2383 TT	EMC	NT$ 5070	C-1-7

Source: BofA Global Research, company data

Price objective basis & risk

Elite Material (ETMCF)

Our PO of NT$8,200 is based on 30x 2H27-1H28E P/E, at the mid-to-high-end of its historical range of 6-34x since 2016. In our view, the multiple is appropriate, given the market-share expansion in server/networking, where we see structural growth in addressable market.

Upside risks are (1) share gain at substrate CCL, (2) stronger 5G smartphone shipment, (3) greater 5G smartphone spec upgrades, and (4) favorable FX and raw material cost change.

Downside risks are (1) share loss at iPhone, (2) keener competition in high-end CCL, and (3) unfavorable FX and raw material cost change.

Kinsus (KNSUF)

We set our PO at NT$1,450 based on 35x 2H27-1H28E P/E, which is at mid-to-high-end level in its historical trading range (8-40x) since 2013. In our view, the multiple is backed by ROE and operating margin recovery to 36% and 25% in 2027-28E (vs 8% and 10% in 2025-26E).

Upside risks to our PO are (1) tighter ABF supply, (2) increasing adoption of SiP and AiP, (3) lower competition pressure and (4) slow development of alternative technology.

Downside risks are (1) greater ABF expansion from peers, (2) muted SiP/AiP adoption, (3) more severe competition, and (4) unfavorable technology development.

NYPCB (NANYF)

Our PO of NT$2,000 is based on 35x 2H27-1H28E P/E. We view this multiple as fair given ROE and operating margin expansion to 39% and 41% in 2027-28E (vs 13% and 14% in 2025-26E).

Upside risks to our PO are (1) tighter ABF supply, (2) higher SiP/AiP adoption, and (3) less intensified competition pressure in PCB business.

Downside risks are (1) greater ABF expansion from peers, (2) muted SiP/AiP adoption, and (3) more severe competition in PCB business.

Unimicron (UMCRF)

Our PO of NT$1,650 is based on 35x 2H27-1H28E, which is roughly 1 standard deviation above the historical average of 20x since 2017. In our view, the multiple is appropriate, as we expect Unimicron's earnings to be supported by its high-end technology offerings, where end market demand seems more resilient.

Upside risks are (1) tighter ABF supply, (2) greater PC and regular server demand, and (3)

lower competition pressure.

Downside risks are (1) greater ABF expansion from peers, (2) lower ASP content increase at AI server, and (3) bigger drop in the demand of consumer electronic products.

Analyst Certification

I, Mike Yang, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

Special Disclosures

Information on securities which are listed on the exchanges where ML Securities (Taiwan) Limited is not permitted to trade or solicit trades for clients is for informational purposes only and is not a recommendation or a solicitation to trade such securities. ML Securities (Taiwan) Limited will not execute transactions for nor accept orders from clients to trade such securities. Foreign investment in Taiwan securities is regulated and restricted. Currently, foreign investment in Taiwan securities is permitted by investment through: (1) global depository receipts, (2) convertible bonds, (3) mutual funds issued offshore of Taiwan, and (4) a special foreign institutional investors (FINIs) and foreign individual investors (FIDIs) program supervised by the Taiwan SFB whereunder FINIs/FIDIs may apply for investment ID to invest in Taiwan securities by registration with Taiwan Stock Exchange. FINIs will additionally need consent from the foreign exchange authority, ie, the Central Bank of China. In addition to the limitations above, various industry-specific percentage-based limitations on foreign ownership of Taiwan companies (and in some cases prohibitions) may apply. Investments are subject to exchange rate and currency conversion restrictions and risks. Dividends and interest earned by foreign investors' Taiwan securities/instruments are generally subject to a 20% withholding tax. Ordinary shares are not available to ML private client accounts in the U.S.

This report is distributed in Taiwan by Merrill Lynch Securities (Taiwan) Limited, which is regulated by the Taiwan SFB.